**3GPP TSG-SA1 Meeting #98e *S1-221131r1***

**Electronic Meeting, 09 – 19 May 2022** *(revision of S1-22xxxx)*

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **22.989** | **CR** | **014** | **rev** | **-** | **Current version:** | **18.4.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network | **X** |

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| ***Title:***  | Real-time automatic translation of languages related use cases |
|  |  |
| ***Source to WG:*** | UIC |
| ***Source to TSG:*** | S1 |
|  |  |
| ***Work item code:*** | *FS\_FRMCS\_Ph5* |  | ***Date:*** | 2022-05-13 |
|  |  |  |  |  |
| ***Category:*** | B |  | ***Release:*** | Rel-19 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
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| ***Reason for change:*** | The language barrier is a significant obstacle to rail interoperability. All train drivers involved in cross-border rail traffic must have sufficient foreign language skills to cover rail operations. Real-time automatic translation of languages enables train drivers and traffic controllers to communicate with one another, irrespective of their native tongue. |
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| ***Summary of change:*** | New use cases related to real-time automatic translation of languages are introduced. |
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| ***Consequences if not approved:*** | Railway needs are not fully covered. |
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| ***Clauses affected:*** | 7.7, 7.7.1, 7.7.2, 7.7.3, 7.7.4, 7.7.5, 7.7.6, 7.7.7. |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** | None. |
|  |  |
| ***This CR's revision history:*** |  |

\* \* \* New change \* \* \*

## 7.7 Real-time automatic translation of languages related use cases

### 7.7.1 Introduction

The language barrier is a significant obstacle to rail interoperability. All train drivers involved in cross-border rail traffic must have sufficient foreign language skills to cover normal operations, but also degraded and emergency situations e.g., traction problems of a train, damaged switch, train driver reporting persons near to track, etc.

Real-time automatic translation of languages enables train drivers and traffic controllers to communicate with one another, irrespective of their native tongue.

Figure XXX illustrates an example of French 🡨🡪 German translation between a French train driver and a German traffic controller when the French train driver is moving to Germany Railways.



Figure 7.7.1-1. Example of French 🡨🡪 German translation between a train driver and a traffic controller

Real-time automatic translation of languages could be considered as a serious game changer for rail interoperability by reducing the cost of language training, by reducing the demands on operating personnel and enables their more flexible assignment, by reducing stress for train drivers when incidents, by enabling the recruitment of staff with minor language skills, by enabling the rail traffic from being rerouted through neighbouring countries.

NOTE: Real-time automatic translation of languages related use cases are limited to point-to-point communications between a train driver and a traffic controller. It may be further extended in the future to other types of communications (e.g., group communications).

### 7.7.2 General overview

Multiple end-to-end approaches for Real-time automatic translation of languages can be operated depending on Railway needs (Railway Operator’s choice):

* Approach #1: Speech to Speech (S2S) transforming the speech of FRMCS User A to anonymous speech for FRMCS User B.
* Approach #2: Speech to Text (S2T) transforming the speech of FRMCS User A to text for FRMCS User B.
* Approach #3: Text to Speech (T2S) transforming the text of FRMCS User A to anonymous speech for FRMCS User B.
* Approach #4: Text to Text (T2T) transforming the text of FRMCS User A to text for FRMCS User B.

Figure 7.7.2-1. Modular architecture of the language translation tool

The translation function and how it works is out of scope of 3GPP. It might be located closed to the FRMCS Users (e.g., edge computing, on-board the train, dispatching system) or centrally (e.g., cloud-based) based on implementation options.

### 7.7.3 Real-time Speech to Speech (S2S) translation

#### 7.7.3.1 Description

When entering a visited Railway Operator in Country B, an FRMCS User A (e.g., a train driver) from Country A may be able to communicate with an FRMCS User B (e.g., traffic controller) from Country B in their respective native tongues.

FRMCS User A is talking and listening in his own native language or dialect used in Country A.

FRMCS User B is talking and listening in his own native language or dialect used in Country B.

#### 7.7.3.2 Pre-conditions

The French lead driver (i.e., an FRMCS User) is authorised to initiate point-to-point communications using Real-Time Speech to Speech translation when entering the German Railways.

The FRMCS System is aware of native language (e.g., French) of the French lead driver (e.g., configuration attributes or pre-selection by the driver).

Both French lead driver and German traffic controller have selected their roles to enable point-to-point communications using Real-Time Speech to Speech translation.

#### 7.7.3.3 Service flows

When crossing the borders from France to Germany, the French lead driver pre-selects the destination language (e.g., German), and, as an option, the source language (e.g., French). As an alternative, the FRMCS System or the language translation tool automatically detects the source language (based on e.g., speech recognition) and the destination language (based on e.g., the location of the lead driver) to be used for translation.

When an incident occurs, the French lead driver initiates a point-to-point communication using Real-Time Speech to Speech translation to the German traffic controller. Once initiated, the French lead driver orally dictates a description of the incident making use of technical railway vocabulary in its native language.

As an option, the French lead driver may then check the displayed translated text in French, his own language, before being sent for translation into German to the traffic controller.

The point-to-point communications using Real-Time Speech to Speech translation are encrypted to prevent eavesdropping.

Source speech, translated text in source language, translated text in destination language and destination speech are recorded (including metadata e.g., timestamp, originator, receiver) in case something bad happens and somebody wants to review the incident later.

Editor’s note: relevant metrics will be further elaborated.

#### 7.7.3.4 Post-conditions

The German traffic controller listens to translated speech in its native language without any major errors of translation in rail terminology. The French lead driver is informed that translated speech has been delivered/received by the German traffic controller.

#### 7.7.3.5 Potential requirements and gap analysis

Editor’s note: potential requirements and gap analysis will be further elaborated.

### 7.7.4 Real-time Speech to Text (S2T) translation

#### 7.7.3.1 Description

When entering a visited Railway Operator in Country B, an FRMCS User A (e.g., a train driver) from Country A may be able to communicate with an FRMCS User B (e.g., traffic controller) from Country B in their respective native tongues.

FRMCS User A is talking and listening in his own native language or dialect used in Country A.

FRMCS User B is typing and receiving translated text in his own native language or dialect used in Country B.

#### 7.7.3.2 Pre-conditions

The French lead driver (i.e., an FRMCS User) is authorised to initiate point-to-point communications using Real-Time Speech to Speech translation when entering the German Railways.

The FRMCS System is aware of native language (e.g., French) of the French lead driver (e.g., configuration attributes or pre-selection by the driver).

Both French lead driver and German traffic controller have selected their roles to enable point-to-point communications using Real-Time Speech to Speech translation.

#### 7.7.3.3 Service flows

When crossing the borders from France to Germany, the French lead driver pre-selects the destination language (e.g., German), and, as an option, the source language (e.g., French). As an alternative, the FRMCS System or the language translation tool automatically detects the source language (based on e.g., speech recognition) and the destination language (based on e.g., the location of the lead driver) to be used for translation.

When an incident occurs, the French lead driver initiates a point-to-point communication using Real-Time Speech to Speech translation to the German traffic controller. Once initiated, the French lead driver orally dictates a description of the incident making use of technical railway vocabulary in its native language.

As an option, the French lead driver may then check the displayed translated text in French, his own language, before being sent for translation into German to the traffic controller.

The point-to-point communications using Real-Time Speech to Speech translation are encrypted to prevent eavesdropping.

Source speech, translated text in source language, and translated text in destination language are recorded (including metadata e.g., timestamp, originator, receiver) in case something bad happens and somebody wants to review the incident later.

Editor’s note: relevant metrics will be further elaborated.

#### 7.7.3.4 Post-conditions

The German traffic controller receives translated text in its native language without any major errors of translation in rail terminology. The French lead driver is informed that translated text has been delivered/received by the German traffic controller.

#### 7.7.3.5 Potential requirements and gap analysis

Editor’s note: potential requirements and gap analysis will be further elaborated.

### 7.7.5 Real-time Text to Speech (T2S) translation

#### 7.7.3.1 Description

When entering a visited Railway Operator in Country B, an FRMCS User A (e.g., a train driver) from Country A may be able to communicate with an FRMCS User B (e.g., traffic controller) from Country B in their respective native tongues.

FRMCS User A is typing and receiving translated text in his own native language or dialect used in Country A.

FRMCS User B is talking and listening in his own native language or dialect used in Country B.

#### 7.7.3.2 Pre-conditions

The French lead driver (i.e., an FRMCS User) is authorised to initiate point-to-point communications using Real-Time Speech to Speech translation when entering the German Railways.

The FRMCS System is aware of native language (e.g., French) of the French lead driver (e.g., configuration attributes or pre-selection by the driver).

Both French lead driver and German traffic controller have selected their roles to enable point-to-point communications using Real-Time Speech to Speech translation.

#### 7.7.3.3 Service flows

When crossing the borders from France to Germany, the French lead driver pre-selects the destination language (e.g., German), and, as an option, the source language (e.g., French). As an alternative, the FRMCS System or the language translation tool automatically detects the source language (based on e.g., speech recognition) and the destination language (based on e.g., the location of the lead driver) to be used for translation.

When an incident occurs, the French lead driver initiates a point-to-point communication using Real-Time Speech to Speech translation to the German traffic controller. Once initiated, the French lead driver enters text description of the incident making use of technical railway vocabulary in its native language.

The point-to-point communications using Real-Time Speech to Speech translation are encrypted to prevent eavesdropping.

Source text, translated text in destination language and destination speech are recorded (including metadata e.g., timestamp, originator, receiver) in case something bad happens and somebody wants to review the incident later.

Editor’s note: relevant metrics will be further elaborated.

#### 7.7.3.4 Post-conditions

The German traffic controller listens to translated speech in its native language without any major errors of translation in rail terminology. The French lead driver is informed that translated text has been delivered/received by the German traffic controller.

#### 7.7.3.5 Potential requirements and gap analysis

Editor’s note: potential requirements and gap analysis will be further elaborated.

### 7.7.6 Real-time Text to Text (T2T) translation

#### 7.7.3.1 Description

When entering a visited Railway Operator in Country B, an FRMCS User A (e.g., a train driver) from Country A may be able to communicate with an FRMCS User B (e.g., traffic controller) from Country B in their respective native tongues.

FRMCS User A is typing and receiving translated text in his own native language or dialect used in Country A.

FRMCS User B is typing and receiving translated text in his own native language or dialect used in Country B.

#### 7.7.3.2 Pre-conditions

The French lead driver (i.e., an FRMCS User) is authorised to initiate point-to-point communications using Real-Time Speech to Speech translation when entering the German Railways.

The FRMCS System is aware of native language (e.g., French) of the French lead driver (e.g., configuration attributes or pre-selection by the driver).

Both French lead driver and German traffic controller have selected their roles to enable point-to-point communications using Real-Time Speech to Speech translation.

#### 7.7.3.3 Service flows

When crossing the borders from France to Germany, the French lead driver pre-selects the destination language (e.g., German), and, as an option, the source language (e.g., French). As an alternative, the FRMCS System or the language translation tool automatically detects the source language (based on e.g., speech recognition) and the destination language (based on e.g., the location of the lead driver) to be used for translation.

When an incident occurs, the French lead driver initiates a point-to-point communication using Real-Time Speech to Speech translation to the German traffic controller. Once initiated, the French lead driver enters text description of the incident making use of technical railway vocabulary in its native language.

The point-to-point communications using Real-Time Speech to Speech translation are encrypted to prevent eavesdropping.

Source text and translated text in destination language are recorded (including metadata e.g., timestamp, originator, receiver) in case something bad happens and somebody wants to review the incident later.

Editor’s note: relevant metrics will be further elaborated.

#### 7.7.3.4 Post-conditions

The German traffic controller receives translated text in its native language without any major errors of translation in rail terminology. The French lead driver is informed that translated text has been delivered/received by the German traffic controller.

#### 7.7.3.5 Potential requirements and gap analysis

Editor’s note: potential requirements and gap analysis will be further elaborated.

### 7.7.7 Service interworking with GSM-R

Service interworking of real-time automatic translation of languages with GSM-R is not required.

\* \* \* End of change \* \* \*